

## PATENT SPECIFICATION

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## (54) APPARATUS FOR MOULDING ARTICLES

(71) I, ZILLA KATHLEEN RUMBLE, of 47 Orchard Court, Portman Square, London, W. 1, a citizen of the Republic of South Africa, do hereby declare the invention, for which I pray that a patent may be granted me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to an improved apparatus for moulding articles. The invention is especially concerned with the moulding of articles having internally projecting surfaces and recesses, such as container or bottle caps formed with internal screw threads.

At the present time articles, such as bottle caps, are normally moulded by a conventional injection moulding process in any suitable plastics or like material, such as polystyrene or polythene. The apparatus normally used includes a pair of die plates one of which is held stationary during a moulding operation while the other plate is movable to open and close the mould parts carried thereby. One of the plates carries the screw formers while the other plate carries the co-operating mould covers. A distribution system is provided in the plates for the supply of the plastics material to the mould cavities between each of the screw formers and its corresponding mould cover when the die plates are in their closed or operative position.

35 The separation of the die plates after a moulding operation in a conventional apparatus as described above is complicated due to the formation of the screw threads or other projections on the moulded article.

40 The article can only be removed from the screw former by a screwing action and usually this is accomplished by a screwing movement of the mould cover as they are separated from the screw formers or supports. The ejection system necessarily in-

cludes an arrangement of cogs, gears and springs which is complicated to design and difficult to maintain.

An object of the present invention is to avoid these disadvantages of conventional systems and to provide an infinitely more simple and quicker ejection system.

According to the invention there is provided an apparatus for moulding articles comprising a pair of die plates, one of which carries a one-piece core member, while the other of which is formed with a cavity fitting over the core member when the plates are moved together to provide the mould, said core member being made of an expandible resilient material, a spigot movable within a passageway in said core member to expand said core member prior to a moulding operation to provide a mould cavity of a desired configuration, and means for withdrawing said spigot after the moulding operation to reduce the size of said core member to facilitate removal of the moulded article therefrom after separation of said die plates.

The core member preferably comprises a flexible collar formed on its outer surface with screw threads or other projecting surfaces to produce the desired shapes on the article to be moulded. The invention thus avoids the time-consuming and complicated screwing arrangement of conventional ejector systems and includes instead a simple push-off ejection tool. In order that the invention may be clearly understood the preferred form of the invention as used in the manufacture of screw-threaded bottle caps will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a diagrammatic side elevation in section of a moulding apparatus in accordance with the invention, the plates being shown in the closed position as during a moulding operation;

Figure 2 is a similar side elevation showing the apparatus in a first position after a moulding operation in which the movable plates have separated from the stationary end plate through which the plastics moulding material is injected;

Figure 3 is a similar side elevation showing a second position in which the mould die plates have separated;

Figure 4 is a similar side elevation showing a third position in which the back plate has separated from the adjacent mould die plate so as to contract the screw former or support;

Figure 5 is a similar side elevation showing a fourth position in which the ejector system has been operated to push the moulded cap from the contracted screw former or support; and

Figure 6 is a perspective view of a collar forming the screw former or support on the die plate.

Referring now to the drawings the moulding apparatus utilizes conventional die plates for the simultaneous moulding of a plurality of internally screw-threaded bottle caps and is shown diagrammatically in Figure 1 with the various plates in the closed position of the tool i.e. in a condition for a moulding operation.

The tool basically comprises three plates which are shown as a back plate 10, a first die plate 11 which carries the desired number of mould formers, one of which is shown at 12, and a second die plate 13 which is formed with cavities 14 providing mould covers which fit over the corresponding screw formers 12 to form the usual mould cavities therebetween.

In the preferred embodiment as shown the tool includes also a fourth plate 15 which is a stationary end plate provided to facilitate the injection of the plastics moulding material to the mould cavities. To this end the stationary plate 15 has a central supply passage 16 connecting with a central duct 17 and communicating passages 18 for the cavities.

As will be hereinafter explained the plates 10, 11 and 13 are all movable relatively to each other, and with respect to the stationary end plate 15 prior to, and after, a moulding operation. After completion of the moulding operation, the plates 10, 11 and 13 are movable as a unit to the left away from the stationary end plate 15 (see Figure 2) and this permits the easy removal of the sprue and runners of the plastics material in the central duct 17 and passages 18 of the die plate 13. The plate 15 is therefore an advantageous, but unessential, part of the tool and can be omitted - in which case the plastics material would be injected directly to the duct 17. If the plate 15 is omitted, the die

plate 13 will usually remain stationary and to indicate such an alternative arrangement the plate 15 has been omitted from Figures 3 to 5 showing the further relative movement of plates 10, 11 and 13 during the opening movement of the tool following a moulding operation.

According to the invention the screw formers 12 are removably mounted in the die plate 11. A screw former 12 is shown in perspective in Figure 6 of the drawings and it is made of a flexible material such as rubber capable of withstanding the high moulding temperature. Each screw former 12 comprises a base or collar portion 19 having an extended portion 20 of greatly reduced cross-sectional area on which the screw-threaded portion 21 is formed. The extended portion 20 is closed at its end 22 but the screw former is formed with a central aperture 23 which is adapted to receive a metal spigot 24 rigidly attached to the back plate 10. The base portion 19 of the screw former 12 is located within a cavity 24' in the die plate 11 and the screw former is held in position by a plate 25 attached by screws 26 in a recessed portion 27 formed in the die plate 11 around the cavity 24'. The plate 25 is formed with an aperture 28 through which the extended portion 20 of the screw former projects for location within the corresponding cavity 14 in the die plate 13 when the plates 11 and 13 are in the closed position for a moulding operation as shown in Figure 1.

In the open position of the tool as shown in Figure 5 of the drawings the metal spigot 24 is withdrawn from the portion of the central aperture 23 formed within the extended portion 20 of the screw former which, therefore, assumes its natural or deflated condition. When the tool is in the closed position as indicated in Figure 1 the various plates are in abutting engagement so that the metal spigot is forced into the central aperture within the extended portion 20 thus expanding the screw former so that it assumes a desired configuration as shown in Figure 1 of the drawings. In this expanded condition the resulting mould cavity is of a desired configuration for the moulding of the bottle cap with an internal screw thread, the plastics material in the mould cavity being shown in the drawings by the reference 29.

The next step in the sequence of operations in the opening movement of the tool is shown in Figure 3. In this step the plates 10 and 11 are moved further to the left as a unit thus separating the die plates 11 and 13 so as to open the mould cavity. As clearly shown in this figure the moulded bottle cap 29 has now been extracted from the cavity 14 in the die plate 13 but is held firmly on the extended portion 20 of the

screw former 12 by reason of the screw threads formed thereon.

The back plate 10 is formed in its rear face with an elongated axial cavity 30 which slidably receives a plate 31 carrying two or more ejector pins 32 which extend through the abutting faces of the plates 10 and 11 and project into the cavity 24' in the die plate 11. The ejector pins 32 pass through elongated passageways 33 in the base portion 19 of the screw formers 12 when these are mounted in the cavity 24' and they also project through corresponding holes 34 in the plate 25. In the closed position of the tool the front ends of the ejector pins 32 are flush with the outer surface of the plate 25 within the mould cavities so that they abut the moulded bottle cap 29 after a moulding operation. At the end of the separation step between the die plates 11 and 13 the plate 31 abuts an operating plunger 35 as shown in Figure 3 of the drawings.

The next step in the sequence of operations in the opening movement of the tool is shown in Figure 4 and it will be seen that during this step the back plate 10 moves further to the left and separates from the die plate 11. Due to abutment of the plate 31 with the plunger 35 the back plate 10 moves relatively to the plate 31 so that the front ends of the ejector pins 32 remain in contact with the moulded bottle cap 29. However, the further movement of the plate 10 withdraws the metal spigot 24 from the front extended portion 20 of the screw former 12 which, therefore, returns to its natural or collapsed condition as shown in Figure 4.

The final step in the sequence of operations in the opening movement of the tool is shown in Figure 5. In this figure the plate 10 has now moved to the left to its final position but just prior to reaching this position the plunger 35 is operated as indicated by the arrow 36 to move the plate 31 forwardly into the base of the cavity 30 so that the ejector pins 32 carried thereby move outwardly from the plate 25 on the die plate 11. This movement pushes the bottle cap 29 over the now collapsed portion 20 of the screw former 12 which is easily and quickly discharged by the simple push-off action.

As shown in the drawings the back plate 10 carries locating rods 37 on which the plates 11 and 13 are slidably mounted. Compression springs 38 are mounted on the rods 37 between the plates 10 and 11 to provide for separation during the opening movement of the tool.

It will, of course, be understood that the ejector pins 31 on plate 32 are returned to their initial position after discharge of the bottle cap by conventional means such as

push back pins.

The invention provides a greatly simplified and quicker method of removing the moulded bottle caps over conventional methods. The necessity to screw the moulded caps from the formers is avoided which therefore eliminates the gears, wheels, springs and cogs previously required.

It will be appreciated that the invention is applicable to the moulding of any articles involving internal screw threads or other projections or indentations, which cause difficulty in their removal from the mould parts. The invention also enables unusual shapes to be moulded which were not previously possible with conventional apparatus.

A particular advantage of the invention is the considerable reduction in time for mould tool design and maintenance and the resulting saving in costs.

It will be appreciated also that the steel plate 25 holding the flexible rubber former 12 in position in the die plate 11 can be quickly removed so that a screw former can be changed or replaced very quickly.

In an alternative form of the invention the metal spigots may be carried by the other or fixed dieplate and as such may form part of the mould covers.

#### WHAT WE CLAIM IS:—

1. An apparatus for moulding articles comprising a pair of die plates, one of which carries a one-piece core member, while the other of which is formed with a cavity fitting over the core member when the plates are moved together to provide the mould, said core member being made of an expandible resilient material, a spigot movable within a passageway in said core member to expand said core member prior to a moulding operation to provide a mould cavity of a desired configuration, and means for withdrawing said spigot after the moulding operation to reduce the size of said core member to facilitate removal of the moulded article therefrom after separation of said die plates.

2. Apparatus as claimed in Claim 1, wherein said core member comprises a flexible collar of resilient material formed on its outer surface with complementary screw threads or other projecting surfaces desired on the article to be moulded.

3. Apparatus as claimed in Claim 2, wherein the core member is formed with a base portion adapted for mounting within a cavity in said one die plate which is provided with detachable means for retaining said base portion in said cavity.

4. Apparatus as claimed in any of the preceding Claims, wherein the spigot slidably extends through said one die plate and is fixedly connected to a back plate which is relatively movable on separation of the

die plates to withdraw the spigot from the core member so as to enable the core member to collapse thereby enabling the moulded article to be pushed or pulled directly therefrom.

5 5. Apparatus as claimed in Claim 4, wherein the relatively movable back plate slidably supports ejector means for engaging the moulded article after separation of the die plates and the withdrawal of the spigot from the core member.

10 6. Apparatus as claimed in any one of the preceding Claims having an end plate adapted to abut said other die plate and 15 which is provided with a passageway for the supply of moulding material thereto.

7. Apparatus as claimed in any one of

the preceding Claims, wherein one die plate is formed with a plurality of screw formers or supports co-operating with a 20 plurality of corresponding cavities in said other die plate for the simultaneous moulding of a plurality of internally screw-threaded bottle caps.

8. Apparatus for the moulding of articles 25 such as bottle caps substantially as described and as shown in the accompanying drawings.

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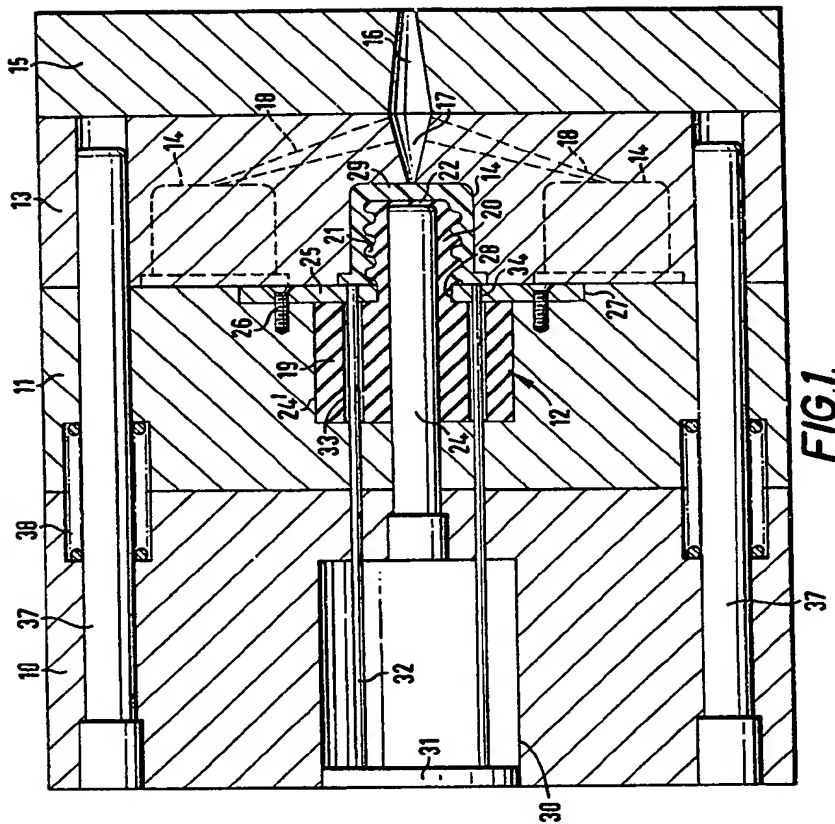
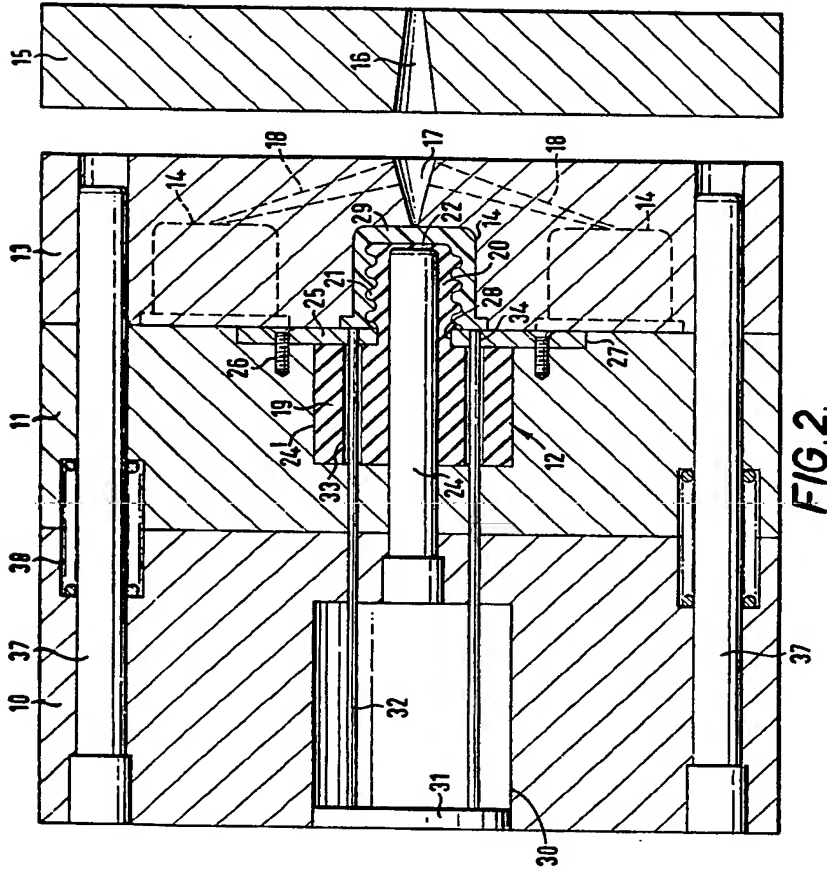


FIG. 1.



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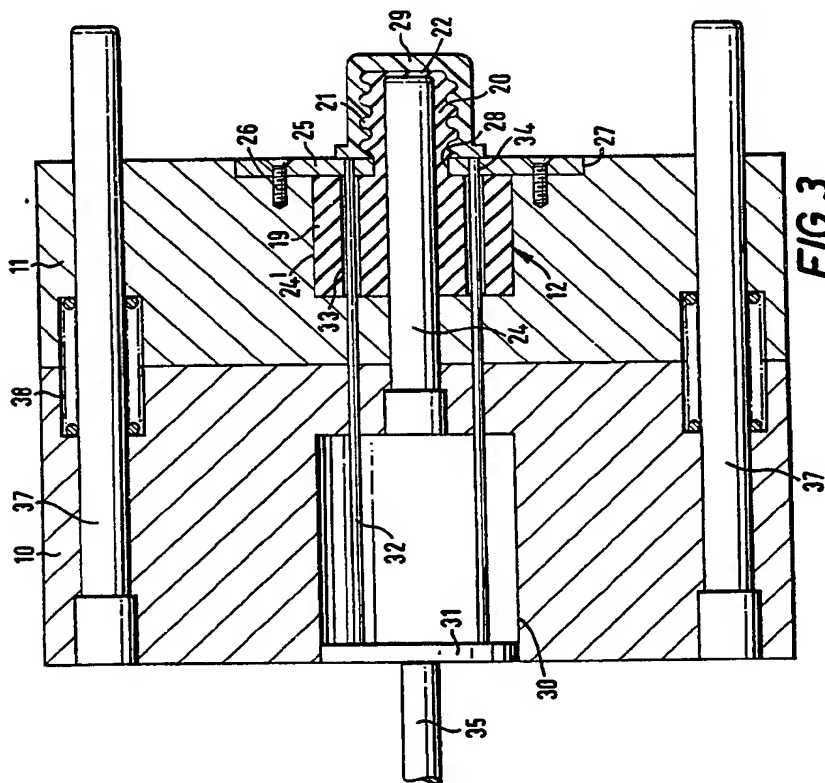
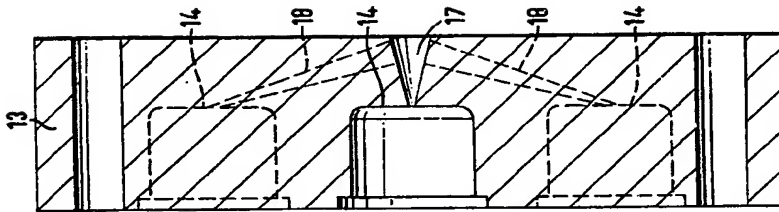


FIG. 3.

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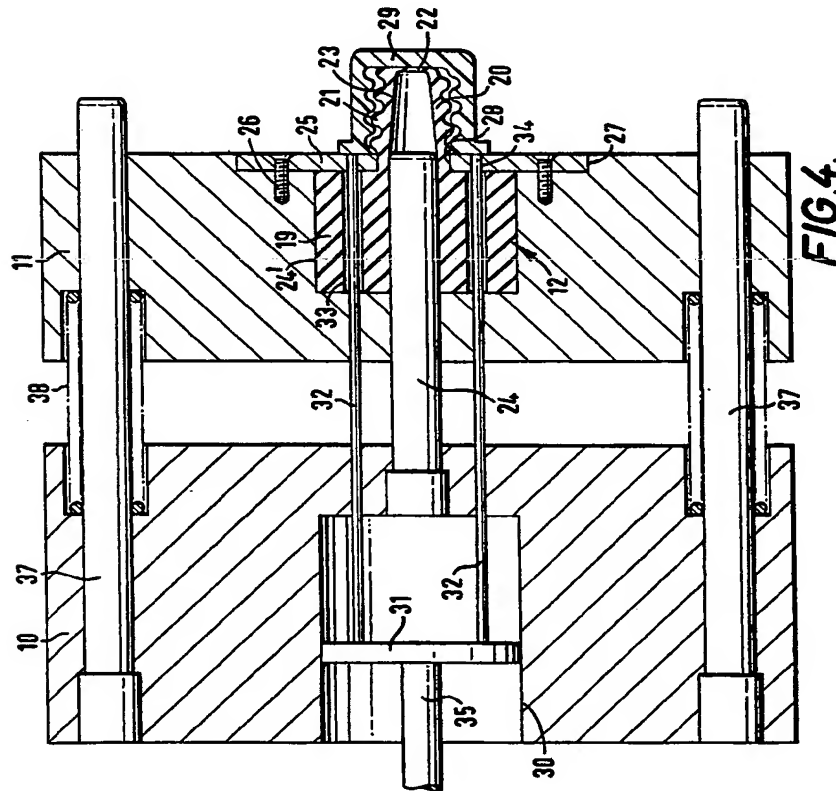
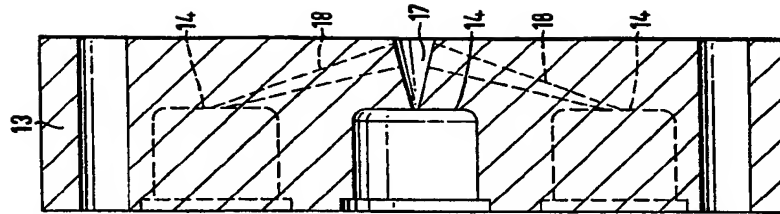


FIG. 4.



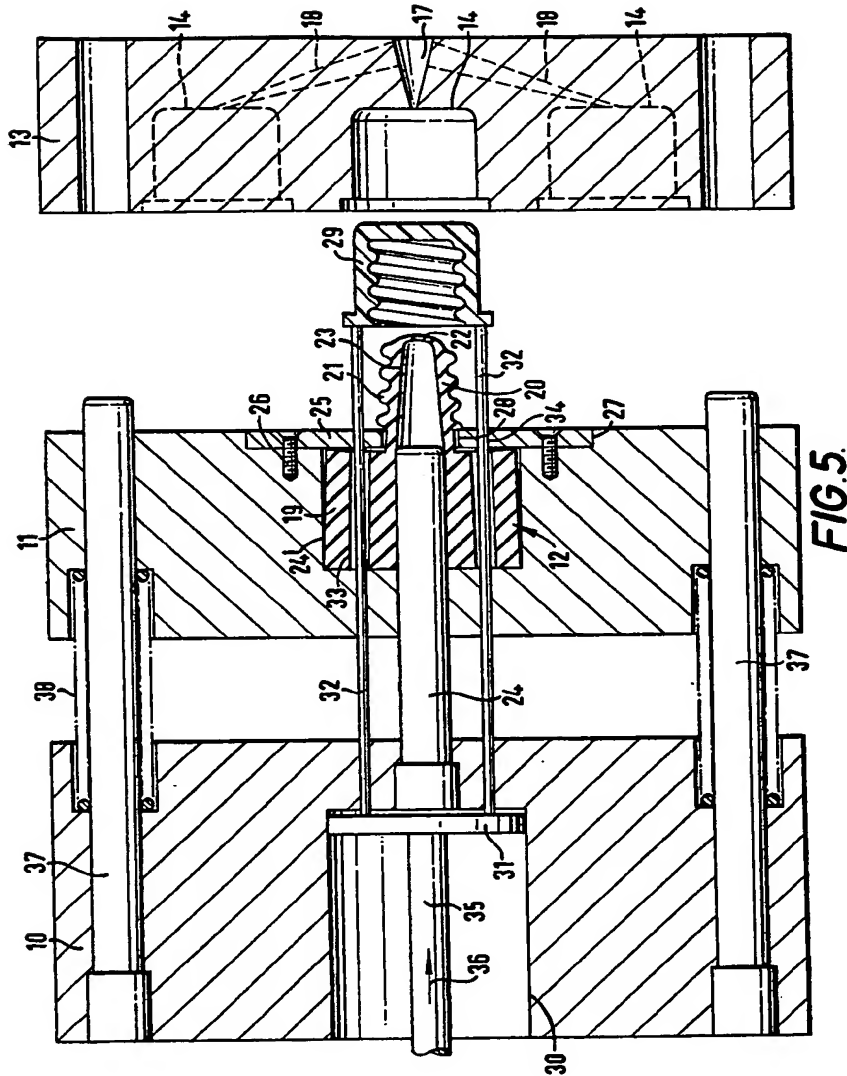
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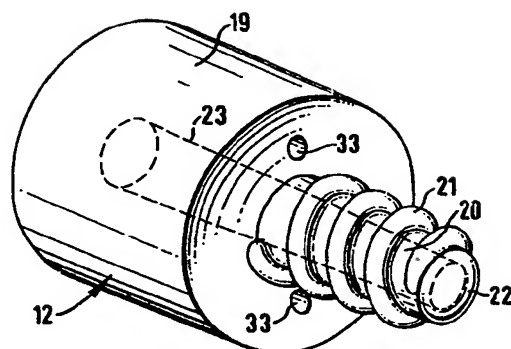
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**FIG. 6.**